

Expected species richness in the genus *Psechrus* in Laos (Araneae: Psechridae)

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Expected species richness in the genus *Psechrus* in Laos (Araneae: Psechridae). - Three new *Psechrus* species are described from Laos, *P. steineri* sp. n., *P. antraeus* sp. n. and *P. ancoralis* sp. n. New records for *P. luangprabang* Jäger, 2007 are listed. Relationships of the three new species to other *Psechrus* species are discussed. Species with similar copulatory organs (*P. singaporensis* Thorell, 1894, *P. rani* Wang & Yin, 2001) are illustrated for comparison. *P. rani* is recorded for the first time from Vietnam.

Keywords: New species - taxonomy - new record - limestone caves - Vietnam.

INTRODUCTION

Psechridae Simon, 1890 are araneomorph, entelegyne and cribellate spiders. Two genera are considered belonging to the *Psechridae*, *Psechrus* Thorell, 1878 and *Fecenia* Simon, 1887 (Platnick, 2009). Representatives of both genera have several traits in common, the most important of which are: secondary eyes feature a grate-shaped tapetum (Homann, 1950, 1971); claw tuft and three claws are present on each leg tarsus (Simon, 1892; Levi, 1982); the calamistrum consists of more than two (i.e. three to four, exceptionally five) rows of setae (Lehtinen, 1967); the first pair of legs is by far the longest (Simon, 1892); gnathocoxae and chelicerae are relatively long and strong (Thorell, 1878). Psechridae are poorly studied and, from what we know from our current experience with this group as well as from the literature (e.g., Levi, 1982), several species have a questionable taxonomical status. The period between 1920 and 1980 saw very few new descriptions of Psechridae. Later, along with the first worldwide revision of the Psechridae, Levi (1982) described four new species. From his re-descriptions of *Psechrus torvus* (O. Pickard-Cambridge, 1869), *P. singaporensis* Thorell, 1894, *P. ghecuanus* Thorell, 1897, *Fecenia ochracea* (Doleschall, 1859) and *F. macilenta* (Simon, 1885), it is likely (or evident meanwhile) that he lumped different species together, as he stated himself in the treatment of *P. singaporensis*. Eight new *Psechrus* species from China were described between 1985 and 2003 (Yin *et al.*, 1985; Wang & Yin, 2001; Chen *et al.*, 2002; Yang *et al.*, 2003) and later two new species

from Laos (Jäger, 2007). It became obvious that species richness of this genus in South-East Asia was so far misjudged. During the last five years the second author undertook several expeditions to Laos, where he collected more *Psechrus* material, which could not be assigned to any described species. These spiders were found in caves and also in different habitats outside. With the present paper we give a detailed characterisation of these spiders.

MATERIAL AND METHODS

Spider material was collected by hand during several expeditions from 2007-2009 in the following provinces of Laos: Khammouan, Vientiane, Huaphan, Luang Prabang, and Luang Nam Tha. All photography, examinations and drawings were done with a Canon EOS 300D (equipped with a Sigma 105 macrolens and a Canon ringlite for taking pictures of living spiders) attached to a Leica MZ 16 stereomicroscope with a camera lucida attachment. The material was preserved in 70% denatured ethanol. Female copulatory organs were dissected and cleared in 96% DL-lactic acid ($C_3H_6O_3$). As the cuticula surrounding the epigyne is very sensitive to lactic acid, only one or two samples were cleared.

All measurements are in mm. Leg formula (from longest to shortest leg) and leg spination pattern follow those applied for Sparassidae in Jäger (2001). Palp and leg lengths are listed as: total (femur, patella, tibia, metatarsus, tarsus). Terminology of structures belonging to the copulatory organs is based on Wang & Yin (2001) except for a few terms explained in the figures. Concerning the receptacula seminis (spermathecae), we are aware that their localisation in Psechridae is not fully understood. Therefore it is not clear if the entire area of one vulva half, which we call 'spermatheca', truly represents a functional spermatheca. In our schematic presentation of the course of the internal duct system the spermathecal head is marked with a "T", the copulatory opening with a circle and the end of the fertilisation duct in direction of the uterus externus with an arrow. When a copulatory opening comprises an elongated slit, the circle is put at the central position of that slit. It should be noted that the course of the internal duct system within the spermathecal bases is often not precisely recognisable, and additionally, that it is variable to a certain degree among the different specimens of the same species examined. As in Jäger (2007: 46ff), slit sense organs and muscle sigilla (if present) close to the epigyne are illustrated as descriptive characters. Arising points of tegular appendages in males are described as clock-positions of the left palp in ventral view.

Abbreviations used in the text: ALE - Anterior lateral eye. AME - Anterior median eye. SB - Serial (individual) numbers of Psechridae examined by the first author. PLE - Posterior lateral eye. PME - Posterior median eye.

Museum collections (with curators): MHNG - Muséum d'histoire naturelle, Geneva, Switzerland (P. Schwendinger). NMI - Natural History Museum of Ireland, Dublin (M. Nolan, N. T. Monaghan). NNM - Nationaal Natuurhistorisch Museum, Leiden, Netherlands (J. Miller). SMF - Senckenberg Museum, Frankfurt am Main, Germany (P. Jäger).

TAXONOMY

FAMILY PSECHRIDAE SIMON, 1890

Genus *Psechrus* Thorell, 1878

Psechrus steineri sp. n.

Figs 1-9, 54, 57, 63

TYPE MATERIAL: ♀ holotype (SB 65), Laos, Khammouan Prov., Ban Nong Ping, Xe Bangfai cave system, Tham Pha Leusi, 17°22'23.4" N, 105°50'28.4" E, inside cave, H. Steiner leg. 15.II.2007, in SMF. – 1 ♂ paratype (SB 64), same data as for holotype, in SMF.

ADDITIONAL MATERIAL: 1 juvenile (SB 66), same data as for holotype, in SMF.

ETYMOLOGY: The specific name is a patronym in honour of the collector, the cave scientist Dr Helmut Steiner; noun (name) in genitive case.

DIAGNOSIS: ♀♀ similar to those of *Psechrus khammouan* Jäger, 2007 in 1) having a similar, anteriorly diverging median septum, 2) copulatory ducts running transversally, 3) spermathecal heads located medio-anteriorly, and 4) spermathecal bases located posteriorly; distinguishable by 1) median septum of epigyne strongly diverging anteriorly, thus margins in most anterior section running more or less parallel with epigastric furrow (see arrows in Fig. 6), 2) distance between copulatory openings more than twice as long as entire length of median septum, 3) copulatory ducts diverging strongly, 4) spermathecal bases partly divided in two sections (Fig. 7). ♂♂ also similar to those of *P. khammouan* in having 1) a similar, bulky tegulum projecting strongly out of cymbial cavity (Figs 1, 3), 2) embolus arising at 12:30 o'clock position on tegulum, but distinguishable by 1) distinctly shorter conductor and embolus (Figs 1-3, tegulum at least three times as long as conductor as well as embolus; in *P. khammouan* less than two times as long), 2) palpal tibia barely diverging distally (Figs 1-3), 3) conductor exhibiting a median ridge distally (Fig. 4), 4) tegulum more than half as long as cymbium (Fig. 1), in *P. khammouan* less than half as long.

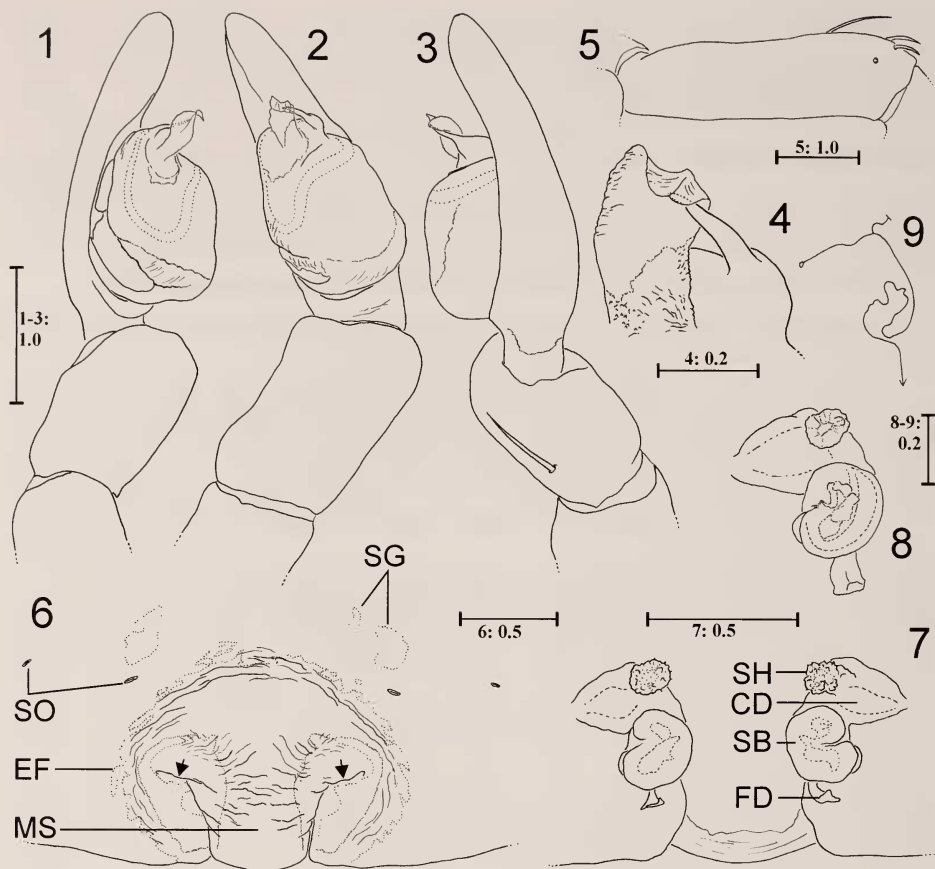
DESCRIPTION MALE (PARATYPE): Body and eye measurements. Prosoma length 8.4, maximal prosoma width 5.8, anterior width of prosoma 3.1, opisthosoma length 9.6, opisthosoma width 3.8. Eyes: AME 0.42, ALE 0.48, PME 0.52, PLE 0.49, AME-AME 0.22, AME-ALE 0.06, PME-PME 0.35, PME-PLE 0.39, AME-PME 0.62, ALE-PLE 0.43, clypeus height at AME 1.04, clypeus height at ALE 0.95.

Cheliceral furrow with three promarginal and five retromarginal teeth.

Spination. Palp: 131, 010, 1100; legs: femur I 666, II 566, III 555(left:656), IV 565; patellae I-IV 000; tibia I 3038(left:3037), II 3038, III 3035, IV 3035; metatarsi I-III 3035, IV 3034.

Measurements of palp and legs. Palp 9.8 [3.6, 1.8, 1.6, 2.8], I 65.9 [16.9, 3.9, 18.5, 19.5, 7.1], II 49.0 [13.0, 3.6, 13.5, 13.2, 5.7], III 33.9 [9.8, 2.8, 8.3, 9.1, 3.9], IV 50.6 [13.5, 3.0, 13.0, 14.7, 6.4]. Leg formula: 1423.

Palp. In addition to characters of bulb mentioned in diagnosis, tegulum broadest centrally (Fig. 2), slightly broader than cymbium. Conductor arising in a 12 o'clock position on tegulum (Fig. 2). Embolus running ventrad (Fig. 3). Sperm duct in ventral view with a bend medially (Fig. 2). Distal half of palpal cymbium (especially on dorsal side) with dense hairs like in most *Psechrus* species (Fig. 54). Palpal femur without modifications (Fig. 5). Palpal tibia with two fields of long, strong and densely arranged



FIGS 1-9

Psechrus steineri sp. n., ♂ paratype (1-5), ♀ holotype (6-9) from Xe Bangfai cave system, Laos. (1-3) Left palp, prolateral (1), ventral (2), retrolateral (3) view. (4) Conductor and embolus of left palp in detail, ventral view. (5) Right palp femur, retrolateral view. (6) Epigyne, ventral view. (7-9) Vulva, dorsal view, with left half in detail (8) and corresponding schematic course of internal duct system (9). CD = copulatory duct; EF = epigynal field; FD = fertilisation duct; MS = median septum; SG = muscle sigilla; SB = spermathecal base; SH = spermathecal head; SO = slit sense organs. Arrows indicate anterolateral margins of median septum, which run more or less parallel to epigastric furrow.

hairs (Fig. 54): a ventral one and a retrolateral one, both clearly separated by an area with only very short hairs. Ventral hair field reaching far down basally, but curved hairs only present in most distal part. Retrolateral hair field situated distally, containing no curved but strong and very densely arranged hairs (Fig. 54). Palpal tibia about 1.4 times longer than broad, generally rectangular in shape (Fig. 2).

Colouration. Prosoma and legs generally light reddish yellow, with two darker reddish brown submarginal bands on prosoma. The latter converging anteriorly and their retrolateral margins more or less equable (the same way as in female, Fig. 57). Legs with darker reddish brown annulate patches. Opisthosoma generally lighter greyish reddish brown, with darker brown patches as well as a light lanceolate area

above heart. Tiny patches scattered over entire opisthosoma and larger chevrons located at median section of opisthosoma. Light median line ventrally on opisthosoma (typical for *Psechrus* spp.) continuous.

DESCRIPTION FEMALE (HOLOTYPE): Body and eye measurements. Prosoma length 8.2, maximal prosoma width 5.5, anterior width of prosoma 3.4, opisthosoma length 10.2, opisthosoma width 4.6. Eyes: AME 0.47, ALE 0.50, PME 0.52, PLE 0.49, AME-AME 0.18, AME-ALE 0.02, PME-PME 0.29, PME-PLE 0.48, AME-PME 0.65, ALE-PLE 0.50, clypeus height at AME 1.19, clypeus height at ALE 1.04.

Cheliceral furrow with three promarginal and four retromarginal teeth. Palpal claw with 13 teeth.

Spination. Palp: 141(I:130), 110, 1011, 1013; legs: femora I-II 556, III 555, IV 554; patellae I-IV 000; tibiae I-II 3038, III 3034, IV 3035; metatarsi I-IV 3035.

Measurements of palp and legs. Palp 9.5 [3.3, 1.5, 1.9, 2.8], I 50.1 [13.9, 3.4, 14.2, 13.0, 5.6], II 40.0 [11.4, 3.2, 10.8, 10.2, 4.4], III 27.6 [8.3, 2.3, 6.8, 7.1, 3.1], IV 41.1 [11.8, 2.8, 10.6, 10.8, 5.1]. Leg formula: 1423.

Copulatory organ. In addition to epigyne and vulva characters mentioned in diagnosis, median septum of epigyne featuring strongly sclerotised, eyebrow-like bulges above copulatory openings, and numerous transversal wrinkles (Fig. 6). Slit sense organs in two pairs outside epigynal field, one of them far outside (Fig. 6). General shape of epigynal field transversally oval. Spermathecal bases separated from each other by more than their length (Fig. 7).

Colouration (Fig. 57): As in male.

Psechrus antraeus sp. n.

Figs 10-23, 55, 58-60, 63

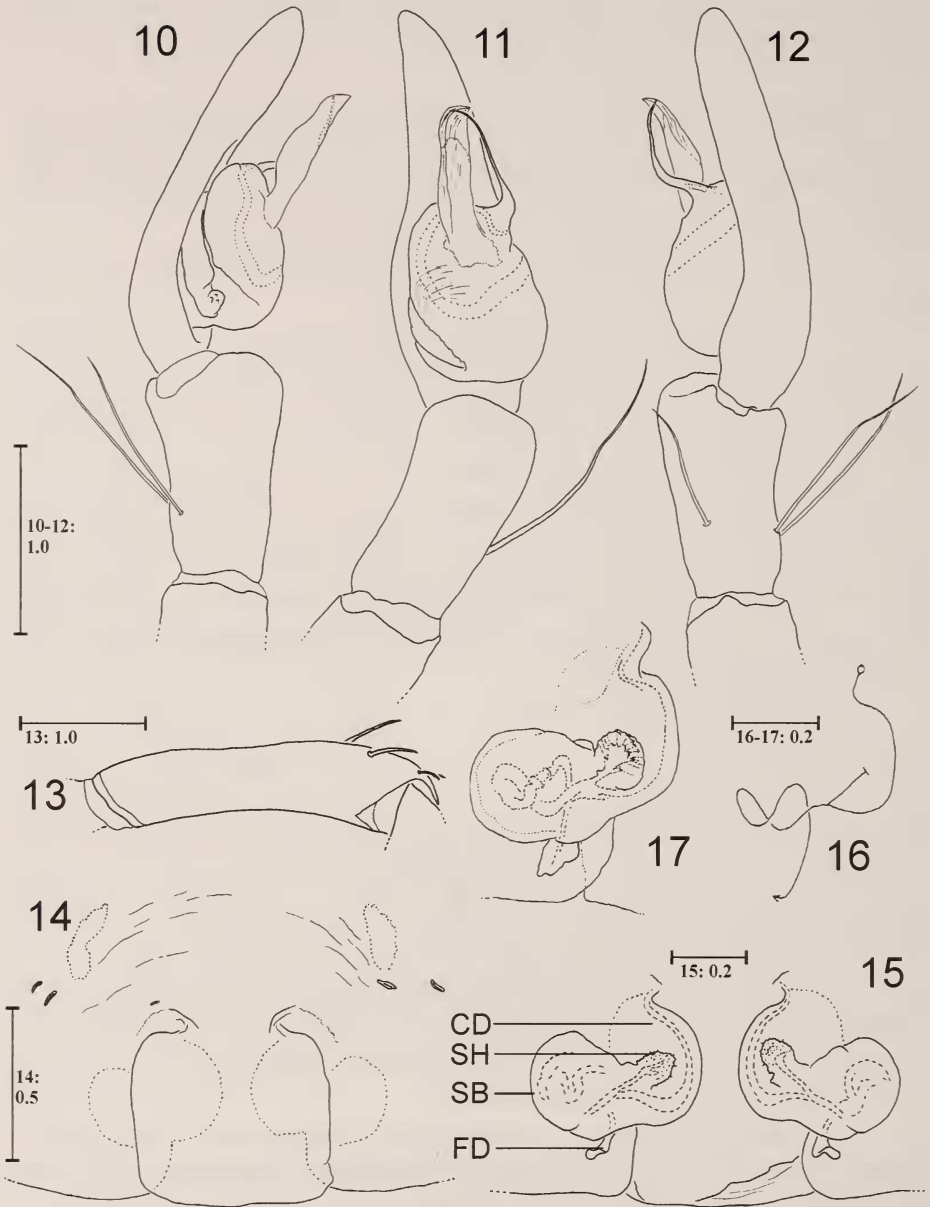
TYPE MATERIAL: ♀ holotype (SB 8), Laos, Vientiane Prov., W of Vang Vieng, Tham Khan, 302 m, 18°55'32.0" N, 102°24'57.7" E, in cave, by hand, P. Jäger leg. 15.III.2008, in SMF. – Paratypes (1 ♂, 4 ♀): 1 ♂ (SB7), same data as for holotype, in SMF. – 2 ♀ (SB 43-44), Laos, Vientiane Prov., W of Vang Vieng, Tham Pou Kham, 260 m, 18°55.549' N, 102°24.734' E, inside limestone cave, by hand, P. Jäger leg. 15.III.2008, in MHNG. – 2 ♀ (SB 73-74), same locality as for SB 43-44, by hand, P. Jäger & F. Steinmetz leg. 13.III.2007, in NNM.

ADDITIONAL MATERIAL: 1 juvenile (SB 45), same data as for SB 43, in SMF.

COMPARATIVE MATERIAL: *Psechrus singaporensis* Thorell, 1894, ♀ holotype (SB 90), Singapore, collected in 1890-1891, Workman Collection [number 1052/ 222], in NMI.

ETYMOLOGY: The specific name refers to the ancient greek word “antraios”, which means ‘out of the cave/grotto’; adjective.

DIAGNOSIS: ♀ ♀ similar to those of *Psechrus singaporensis* Thorell, 1894 in having a similar vulva with spermathecal bases located postero-laterally, but distinguishable by 1) lack of epigynal field, 2) roughly square median septum (Fig. 14), i.e. lateral margins running more or less parallel to each other (not converging anteriorly as in *P. singaporensis*, Fig. 24), 3) median septum with a narrow section (“septum bottle neck”) anteriorly next to copulatory openings, 4) distance between copulatory openings at most half as long as entire septum length, 5) copulatory ducts longer than in *P. singaporensis* and with sharp bend anteriorly (see arrow in Fig. 21), 6) spermathecal bases broader than in *P. singaporensis*, moreover, spermathecal heads almost mediad (Fig. 15). ♂ with conductor as well as embolus almost as long as tegulum (Figs



FIGS 10-17

Psechrus antraeus sp. n., ♂ paratype (10-13), ♀ holotype (14-17) from caves in the Vang Vieng region, Laos. (10-12) Left palp, prolateral (10), ventral (11), retrolateral (12) view. (13) Right palpal femur, retrolateral view. (14) Epigyne, ventral view. (15-17) Vulva, dorsal view, with schematic course of internal duct system (16) and detail of left half (17). CD = copulatory duct; FD = fertilisation duct; SB = spermathecal base; SH = spermathecal head.

10-12), the latter less than half as long as cymbium. Conductor more or less straight, not folded apically, and parallel to longitudinal axis of cymbium (Fig. 10).

DESCRIPTION MALE (paratype SB 7): Body and eye measurements. Prosoma length 5.5, maximal prosoma width 3.9, anterior width of prosoma 2.2, opisthosoma length 5.8, opisthosoma width 2.4. Eyes: AME 0.31, ALE 0.44, PME 0.42, PLE 0.42, AME-AME 0.11, AME-ALE 0.03, PME-PME 0.18, PME-PLE 0.26, AME-PME 0.47, ALE-PLE 0.38, clypeus height at AME 0.68, clypeus height at ALE 0.59.

Cheliceral furrow with three promarginal and five retromarginal teeth.

Spination. Palp: 131, 010, 1101; legs: femora I-II 566, III-IV 555; patellae I-IV 000; tibia I 3038(r303 10), II 3038, III 3034, IV 3036; metatarsi I 3038, II-III 3035, IV 3037.

Measurements of palp and legs. Palp 7.2 [2.5, 1.2, 1.1, 2.4], I 53.8 [14.4, 2.6, 14.7, 15.4, 6.7], II 41.2 [11.2, 2.5, 10.9, 11.6, 5.0], III 26.4 [7.7, 2.0, 6.2, 7.1, 3.4], IV 42.4 [11.4, 2.1, 10.6, 12.4, 5.9]. Leg formula: 1423.

Palp. In addition to characters of palp mentioned in diagnosis, tegulum broadest basally (Fig. 11), as broad as cymbium. Embolus arising in a 1 o'clock position on tegulum, conductor in a 12 o'clock position (Fig. 11). Sperm duct in ventral view without bend (Fig. 11). Distal half of palpal cymbium (especially on dorsal side) with dense hair cover like in most *Psechrus* species (Fig. 55). Palpal femur without modifications (Fig. 13). Dense hair cover on distal and ventral parts of palpal tibia as described for *P. steineri* sp. n., but retrolateral hair field (Fig. 55) not as strongly developed. Palpal tibia about 1.6 times longer than broad, diverging distally (Fig. 10).

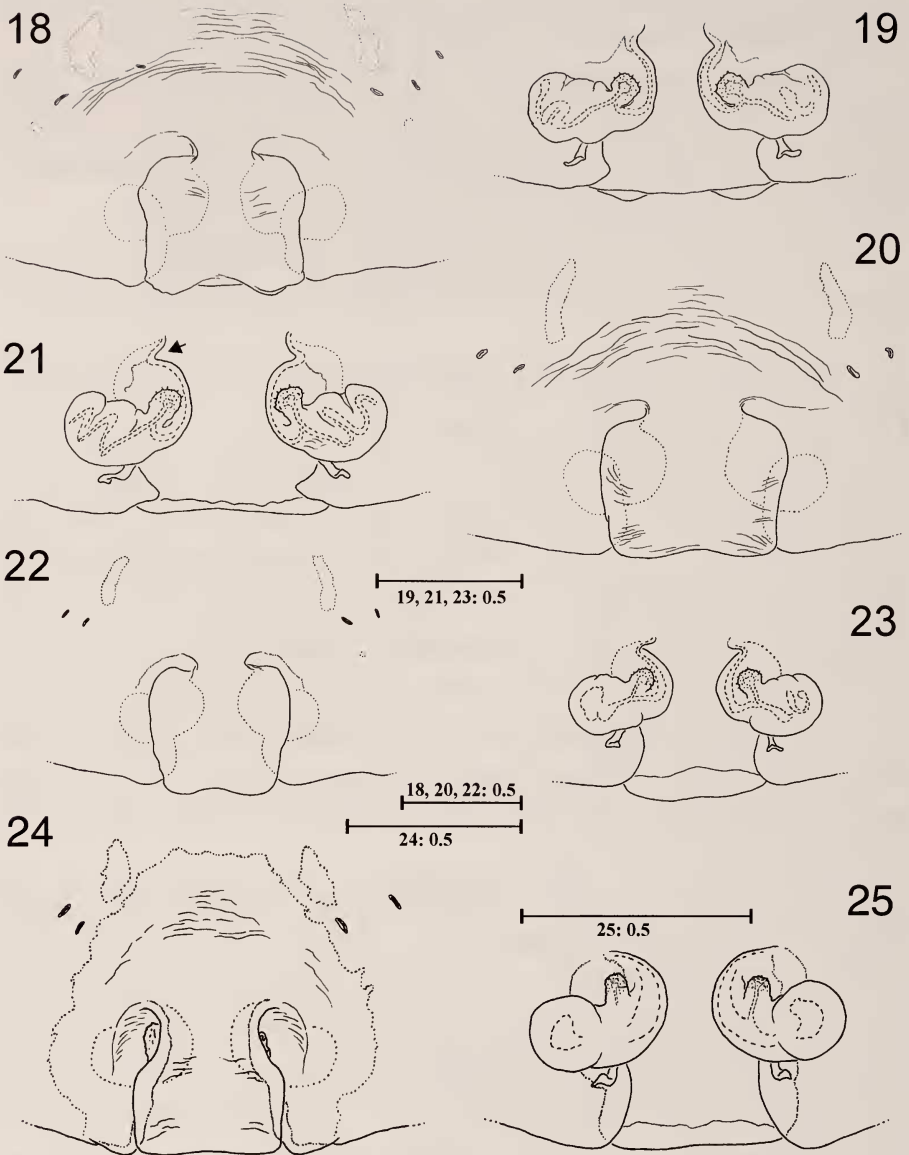
Colouration. General colouration of prosoma light greyish beige-brown, with two darker brown submarginal bands on prosoma, these converging anteriorly and having slightly serrated retrolateral margins (as shown for females, Figs 58, 60). Legs generally coloured like prosoma, but with dark brown (almost black) annulate patches. Opisthosoma like in *P. steineri* sp. n.

DESCRIPTION FEMALE (n=5, measurements of holotype first, those of other specimens given as ranges in parentheses): Body and eye measurements. Prosoma length 5.7 (5.5-7.3), maximal prosoma width 4.0 (3.9-4.9), anterior width of prosoma 2.5 (2.5-3.1), opisthosoma length 7.6 (7.3-10.1), opisthosoma width 3.6 (3.5-5.2). Eyes: AME 0.37 (0.36-0.44), ALE 0.40 (0.40-0.49), PME 0.45 (0.45-0.47), PLE 0.44 (0.43-0.49), AME-AME 0.12 (0.12-0.17), AME-ALE 0.06 (0.03-0.06), PME-PME 0.22 (0.18-0.25), PME-PLE 0.35 (0.24-0.39), AME-PME 0.44 (0.44-0.53), ALE-PLE 0.36 (0.26-0.36), clypeus height at AME 0.75 (0.75-1.23), clypeus height at ALE 0.70 (0.68-1.09).

Cheliceral furrow with three promarginal and six retromarginal teeth. Palpal claw with 13 (n=3, incl. holotype) or 14 (n=2) teeth.

Spination. Palp: 131(r141), 110, 1101, 1013 (131, 110, 1101, 1013, n=4; 131, 110, 1101, 2013, n=1). Legs: femora I-II 556, III-IV 555 (I-II 556, III-IV 555, n=4; I-II 556, III 555, IV 545, n=1); patellae I-IV 000 (I-IV 000); tibiae I-II 3038, III 3234, IV 3033 (I-II 3038, III-IV 3136, n=3; I-II 3038, III 3134, IV 3033, n=1); metatarsi I-IV 3035 (I-III 3035, IV 3034, n=3; I-IV 3035, n=2).

Measurements of palp and legs. Palp 7.2 (7.0-9.0) [2.6 (2.5-3.1), 1.0 (1.0-1.2), 1.3 (1.3-1.7), 2.3 (2.2-3.0)], I 37.9 (36.9-46.8) [10.3 (10.1-12.2), 2.4 (2.4-3.0), 10.9



Figs 18-25

Psechrus spp., ♀ copulatory organ. (18-23) *Psechrus antraeus* sp. n., ♀ paratypes, intraspecific variation of copulatory organ; SB 74 (18-19), SB 43 (20-21), SB 73 (22-23). (24-25) *Psechrus singaporensis* Thorell, 1894, ♀ holotype. (18, 20, 22, 24) Epigyne, ventral view. (19, 21, 23, 25) Vulva, dorsal view. Arrow indicates sharp anterior bend of copulatory duct.

(10.7-13.9), 9.9 (9.9-12.2), 4.4 (4.3-5.5)], II 29.9 (28.9-37.2) [8.8 (8.5-10.6), 2.0 (2.0-2.7), 8.0 (7.7-9.9), 7.6 (7.3-9.6), 3.5 (3.4-4.4)], III 20.8 (20.0-26.1) [6.3 (6.0-7.9), 1.7 (1.6-2.1), 5.1 (5.0-6.4), 5.2 (5.0-6.6), 2.5 (2.4-3.1)], IV 30.9 (28.9-38.2) [9.1 (8.5-10.9), 1.9 (1.8-2.5), 7.9 (7.6-10.0), 8.0 (7.6-10.1), 4.0 (3.9-4.7)]. Leg formula: 1423 (n=5).

Copulatory organ. In addition to characters of epigyne and vulva mentioned in diagnosis, muscle sigilla anterior to epigyne mostly elongated (Figs 18, 20, 22). At least four slit sense organs present, varying in shape and position. Spermathecal bases separated by less than their length.

Colouration (Figs 58, 60). As in male. Colouration of juvenile very similar (Fig. 59).

VARIATION OF COPULATORY ORGANS: ♀♀ examined differing slightly in shape of median septum: posterior margin more or less recurved (Figs 18, 20, 22). 2 ♀ with one of the two anterior muscle sigilla rather stout (Figs 14, 18). The curved wrinkles posteriorly and medially of that sigilla (typical for a *Psechrus* epigyne) sometimes not very well recognisable (Figs 14, 22). Distance between spermathecal bases varying (Fig. 15 cf. Fig. 21). Spermathecal bases of different widths (Fig. 19 cf. Fig. 23).

Psechrus ancoralis sp. n.

Figs 26-40, 44-53, 56, 61-63

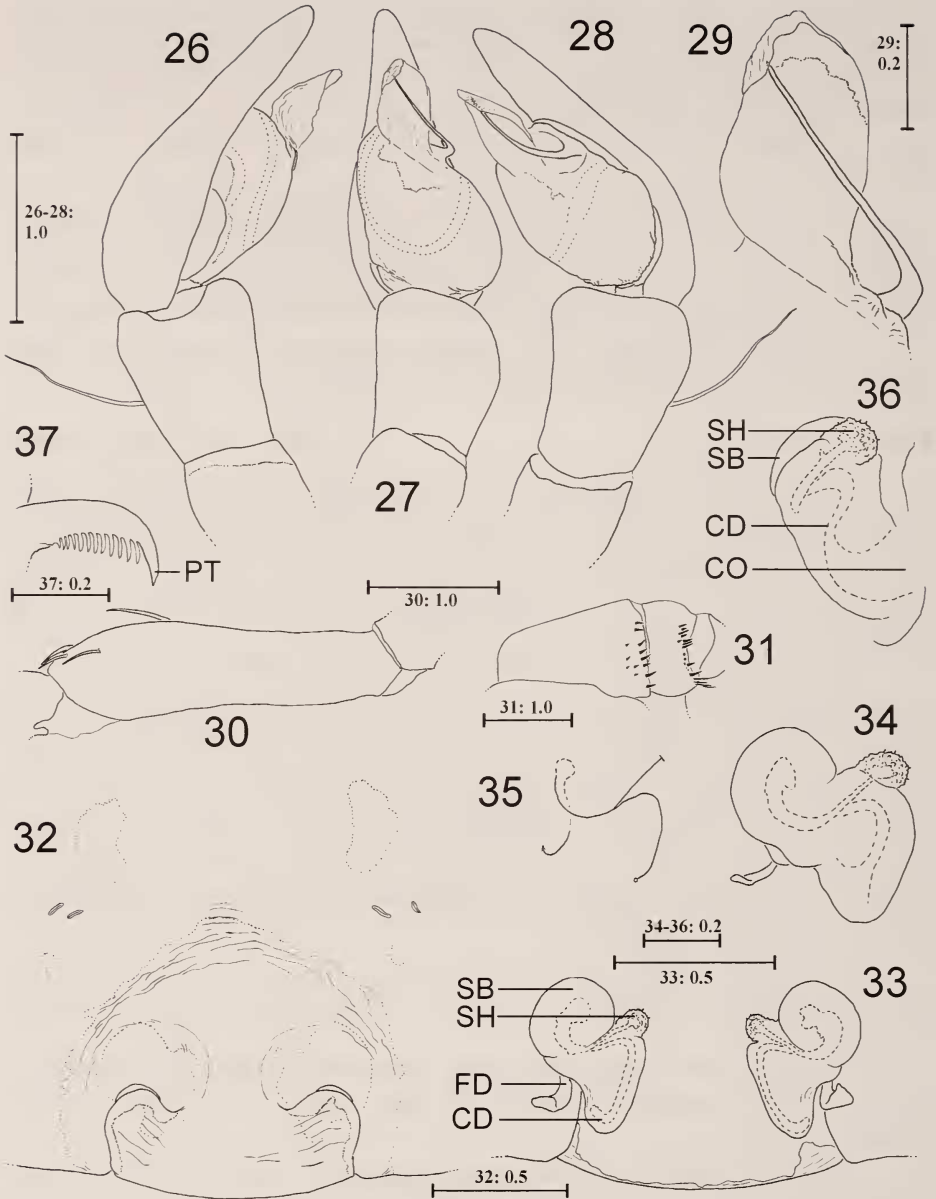
TYPE MATERIAL: ♀ holotype (SB 4), Laos, Luang Nam Tha Prov., Nam Ha Protected Area (3), 746 m, 21°08'17.6" N, 101°21'07.3" E, under bridge, by hand, P. Jäger leg. 6.III.2008, in SMF. – Paratypes (2 ♂, 5 ♀): 2 ♀ (SB 3, SB 5), same data as for holotype, in SMF. – 2 ♀ (SB 23, SB 27), Laos, Luang Nam Tha Prov., Nam Ha Protected Area (2), 693 m, 21°06'43.0" N, 101°20'36.1" E, under bridge, by hand, P. Jäger leg. 6.III.2008, in MHNG. – 1 ♂ (SB 26), same data as for SB 23, in SMF. – 1 ♂ (SB 24), same data as for SB 23, in MHNG. – 1 ♀ (SB 55), Laos, Luang Nam Tha Prov., Nam Ha Protected Area (6), 589 m, 21°03'32.1" N, 101°24'03.0" E, under bridge, by hand, P. Jäger leg. 7.III.2008, in NNM.

ADDITIONAL MATERIAL (9 ♀): Laos, Luang Nam Tha Prov.: 3 ♀ (SB 33-35), Vieng Pou Kha, Ban Nam Eng, Kao Rao cave, 729 m, 20°43'30.5" N, 101°09'14.9" E, entrance of cave and aphotic zone, by hand, P. Jäger leg. 3.III.2008, in SMF. – 2 ♀ (SB 46-47), Vieng Pou Kha, Tham Pasat Thia, NW entrance, 705 m, 20°46'37.2" N, 101°01'00.2" E, inside cave, by hand, P. Jäger leg. 4.III.2008, in MHNG. – 1 ♀ (SB 70), Vieng Pou Kha, Tham Pasat Thia (2), 20°46'45.2" N, 101°00'49.7" E, in cave, by hand, H. Steiner leg. 9.II.2006, in NNM. Luang Prabang Prov.: 1 ♀ (SB 75), Tham Seua, 19°26'55.7" N, 102°26'09.4" E, H. Steiner leg. 4.II.2005, in SMF. – 1 ♀ (SB 88), NE of Luang Prabang, Nam Ou, Nong Khiao, Tham Pathok, 373 m, 20°33.082' N, 102°37.925' E, outside cave, by hand, at night, P. Jäger leg. 29.II.2008, in SMF. Huaphan Prov.: 1 ♀ (SB 13), Vieng Thong, Tham Mue (F48-135-010), 20°16'54.7" N, 103°22'18.4" E, H. Steiner leg. 15.I.2009, in SMF.

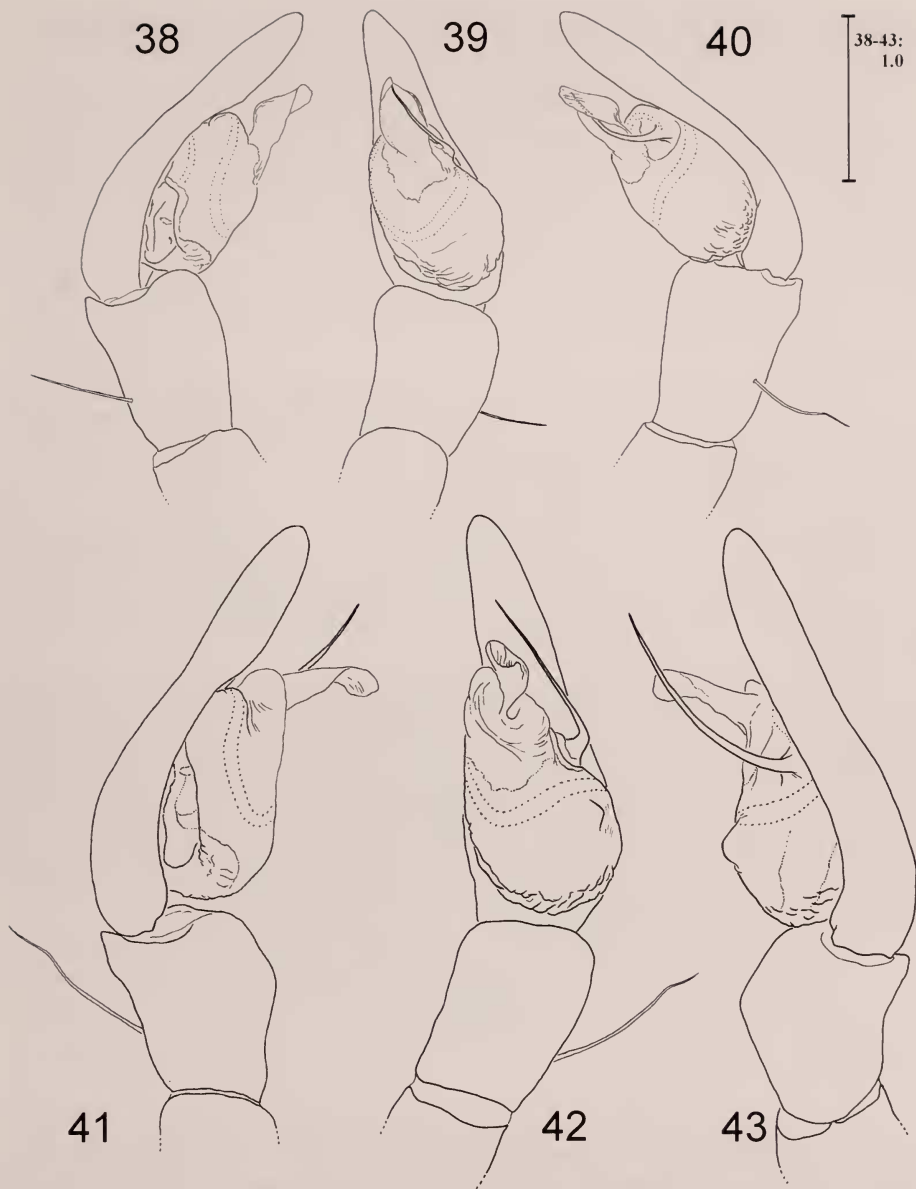
COMPARATIVE MATERIAL: *Psechrus rani* Wang & Yin, 2001, 1 ♂ (SB 122), Vietnam, Lang Son Prov., Hong Phong, Cave Mudi, P. Beron & D. Karucharov leg. 13.III.1986, Deeleman Collection, in NNM.

ETYMOLOGY: The specific name refers to the shape of the median septum of the epigyne, which resembles an anchor; the latin word "ancora" means 'anchor'; adjective.

DIAGNOSIS: Epigyne of females with characteristic shape of median septum, somewhat resembling an anchor (Fig. 32). Septum at least twice as broad as long. Vulva with spermathecal bases located anterolaterally and copulatory ducts located posteromedially (Fig. 33). Copulatory openings in posterior portion of copulatory duct (Fig. 36). Males similar to those of *Psechrus rani* Wang & Yin, 2001 in having a similar bulb with apical portion of conductor folded retrolaterad to ventrad (Figs 26-28 cf. Figs 38-43) and a basally broad tegulum (Figs 27, 39 cf. Fig. 42), but distinguishable by 1) lack of voluminous base of conductor (as shown in Fig. 42 and in Wang & Yin, 2001: fig. 13 for *P. rani*), 2) subdistal part of conductor (Figs 27, 39)



FIGS 26-37. *Psechrus ancoralis* sp. n., ♂ paratype SB 24 (26-29), ♂ paratype SB 26 (30-31), ♀ holotype (32-33), ♀ paratype SB 55 (37), all from Luang Nam Tha Prov., Laos; ♀ SB 75 (34-36), from Luang Prabang Prov., Laos. (26-28) Right palp, mirrored, prolateral (26), ventral (27), retrolateral (28) view. (29) Conductor and embolus of right palp in detail, mirrored, ventral view. (30) Left palpal femur, retrolateral view. (31) Coxa and trochanter, right leg I, retrolateral-ventral view. (32) Epigyne, ventral view. (33-36) Vulva, dorsal view; left half in detail (34), schematic course of internal duct system (35), left half, prolateral-median view (36). (37) Left palpal claw, prolateral view. CD = copulatory duct; CO = copulatory opening; FD = fertilisation duct; PT = primary tooth (of palpal claw); SB = spermathecal base; SH = spermathecal head.



FIGS 38-43

Psechrus spp., left ♂ palp of *P. ancoralis* sp. n., paratype SB 26 (38-40) and *P. rani* Wang & Yin, 2001, from Vietnam (41-43). (38, 41) Prolateral view. (39, 42) Ventral view. (40, 43) Retrolateral view (in Fig. 43 dorsal tibial spine omitted).

broader than in *P. rani* (Fig. 42), 3) embolus shorter (only about half as long as tegulum, Figs 27-28, 39-40) than in *P. rani* (about as long as tegulum, Figs 42-43; embolus also visible in prolateral view, Fig. 41), 4) sperm duct U-shaped (Figs 28, 39)

instead of running more or less transversally like in *P. rani* (Fig. 42), 5) body and ♂ copulatory organ (Figs 38-40 cf. Figs 41-43) distinctly smaller.

DESCRIPTION MALE (n=2, measurements of paratype SB 26 first, those of paratype SB 24 in parentheses): Body and eye measurements. Prosoma length 5.5 (4.8), maximal prosoma width 3.9 (3.4), anterior width of prosoma 2.3 (1.8), opisthosoma length 6.8 (5.6), opisthosoma width 2.8 (2.5). Eyes: AME 0.32 (0.27), ALE 0.35 (0.32), PME 0.39 (0.35), PLE 0.35 (0.31), AME-AME 0.13 (0.12), AME-ALE 0.04 (0.01), PME-PME 0.16 (0.18), PME-PLE 0.27 (0.24), AME-PME 0.40 (0.38), ALE-PLE 0.30 (0.27), clypeus height at AME 0.76 (0.60), clypeus height at ALE 0.68 (0.52).

Cheliceral furrow with three promarginal and six (SB 26) or five (SB 24) retromarginal teeth.

Spination. Palp: 131, 010, 0110 (131, 010[right:110], 0110); legs: femur I 556, II-III 555, IV 554 (I-III 556); patellae I-IV 000 (I-III 000); tibia I 3038, II 3038, III-IV 3035 (I-II 3038, III 3034); metatarsi I-IV 3035 (I-III 3035). Coxae and trochanteri of first walking legs with short, pointed macrosetae (Fig. 31).

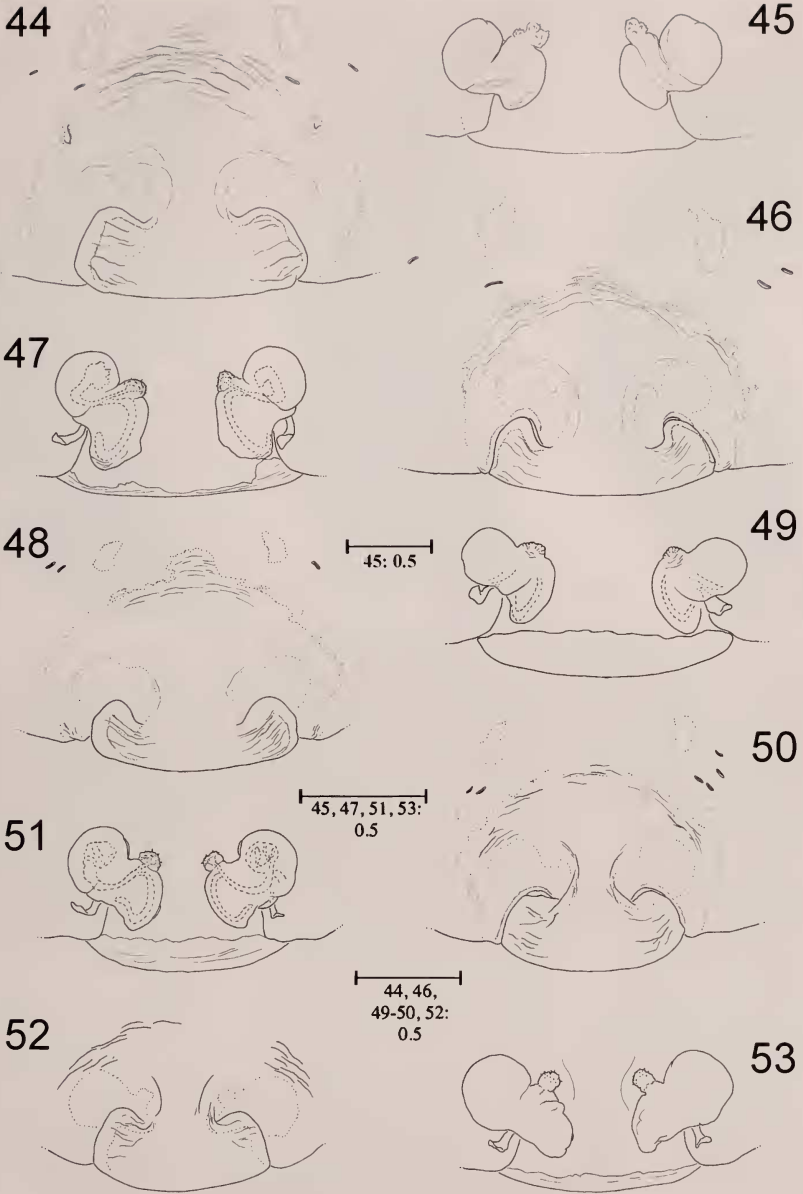
Measurements of palp and legs. Palp 6.7 [2.2, 1.2, 1.2, 2.1] (6.72 [2.2, 1.1, 1.0, 1.9]), I 42.3 [10.9, 2.5, 11.9, 12.5, 4.5] (37.6 [9.5, 2.2, 10.3, 10.5, 5.1]), II 33.7 [9.1, 2.3, 8.7, 9.4, 4.2] (29.4 [7.7, 2.0, 7.8, 8.0, 3.9]), III 22.8 [6.5, 1.8, 5.4, 6.0, 3.1] (19.6 [5.5, 1.5, 4.7, 5.1, 2.8]), IV 33.6 [9.2, 2.0, 8.8, 9.7, 3.9] Leg formula: 1423 (SB 24: both legs IV lost).

Palp. In addition to characters of the bulb mentioned in diagnosis, tegulum slightly broader than cymbium (Fig. 27). Embolus arising in a 1 o'clock position on tegulum, conductor in a 12 o'clock position. Sperm duct in ventral view without bend, hence U-shaped (Fig. 27). Distal half of palpal cymbium (particularly dorsally) with dense hair cover like in most *Psechrus* species. Palpal femur without modifications (Fig. 30). Dense hair cover, as described for *P. steineri* sp. n., only visible in distal portion of palpal tibia (Fig. 56); only (distal) ventral hair field strongly developed. Palpal tibia 1.1-1.3 times longer than broad, diverging distally (Figs 26, 28).

Colouration. General colouration of prosoma and legs light reddish greyish brown, with two darker brown submarginal bands on prosoma, the latter converging anteriorly and having serrated retrolateral margins (Figs 61-62), and with darker brown (almost black) annulate patches on legs. Opisthosoma colouration like in *P. antraeus* sp. n.

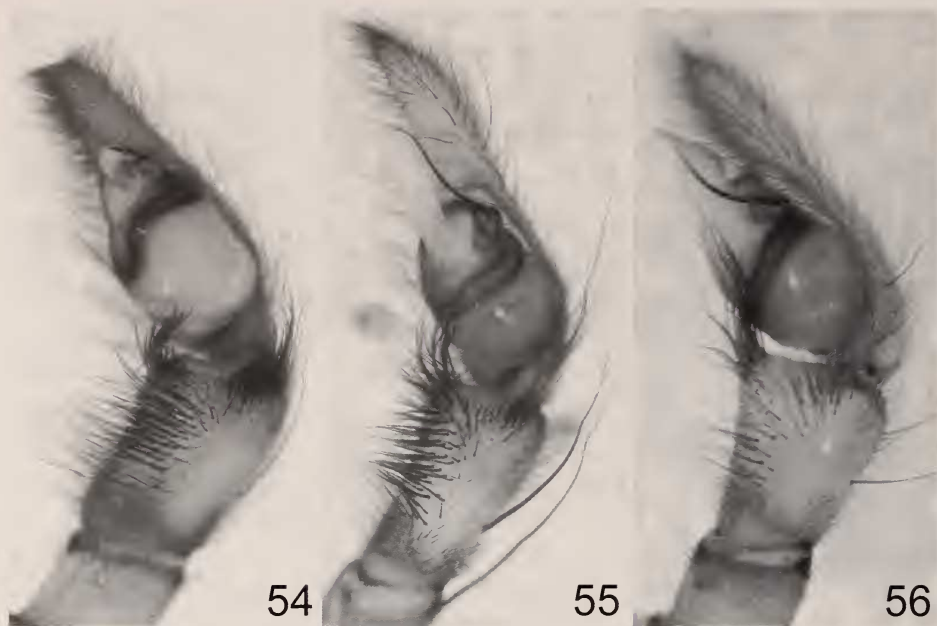
DESCRIPTION FEMALE (n=15, measurements of holotype first, those of other specimens given as ranges in parentheses): Body and eye measurements. Prosoma length 7.7 (4.0-7.8), maximal prosoma width 5.6 (3.3-5.6), anterior width of prosoma 3.2 (2.1-3.2), opisthosoma length 10.2 (6.6-11.8), opisthosoma width 5.2 (3.6-8.0). Eyes: AME 0.41 (0.31-0.41), ALE 0.45 (0.38-0.49), PME 0.53 (0.42-0.55), PLE 0.49 (0.39-0.49), AME-AME 0.19 (0.13-0.22), AME-ALE 0.03 (0.03-0.07), PME-PME 0.26 (0.18-0.28), PME-PLE 0.38 (0.28-0.42), AME-PME 0.56 (0.47-0.63), ALE-PLE 0.46 (0.32-0.46), clypeus height at AME 1.21 (0.72-1.21), clypeus height at ALE 1.04 (0.69-1.11).

Cheliceral furrow with three promarginal and five (n=3, incl. holotype) or six (n=12) retromarginal teeth. Palpal claw with 13 (n=1), 14 (n=9), 15 (n=1) or 16 (n=1,



FIGS 44-53

Psechrus ancoralis sp. n., variation of ♀ copulatory organs; SB 88, Luang Prabang Prov. (44-45), paratype SB 3, Luang Nam Tha Prov. (46-47), SB 13, Huaphan Prov. (48-49), SB 34, Luang Nam Tha Prov. (50-51), SB 70, Luang Nam Tha Prov. (52-53). (44, 46, 48, 50, 52) Epigyne, ventral view. (45, 47, 49, 51, 53) Vulva, dorsal view.



FIGS 54-56

Psechrus spp., left palp, retrolateral-ventral view. (54) *Psechrus steineri* sp. n., ♂ paratype. (55) *Psechrus antraeus* sp. n., ♂ paratype. (56) *Psechrus ancoralis* sp. n., ♂ paratype SB 24.

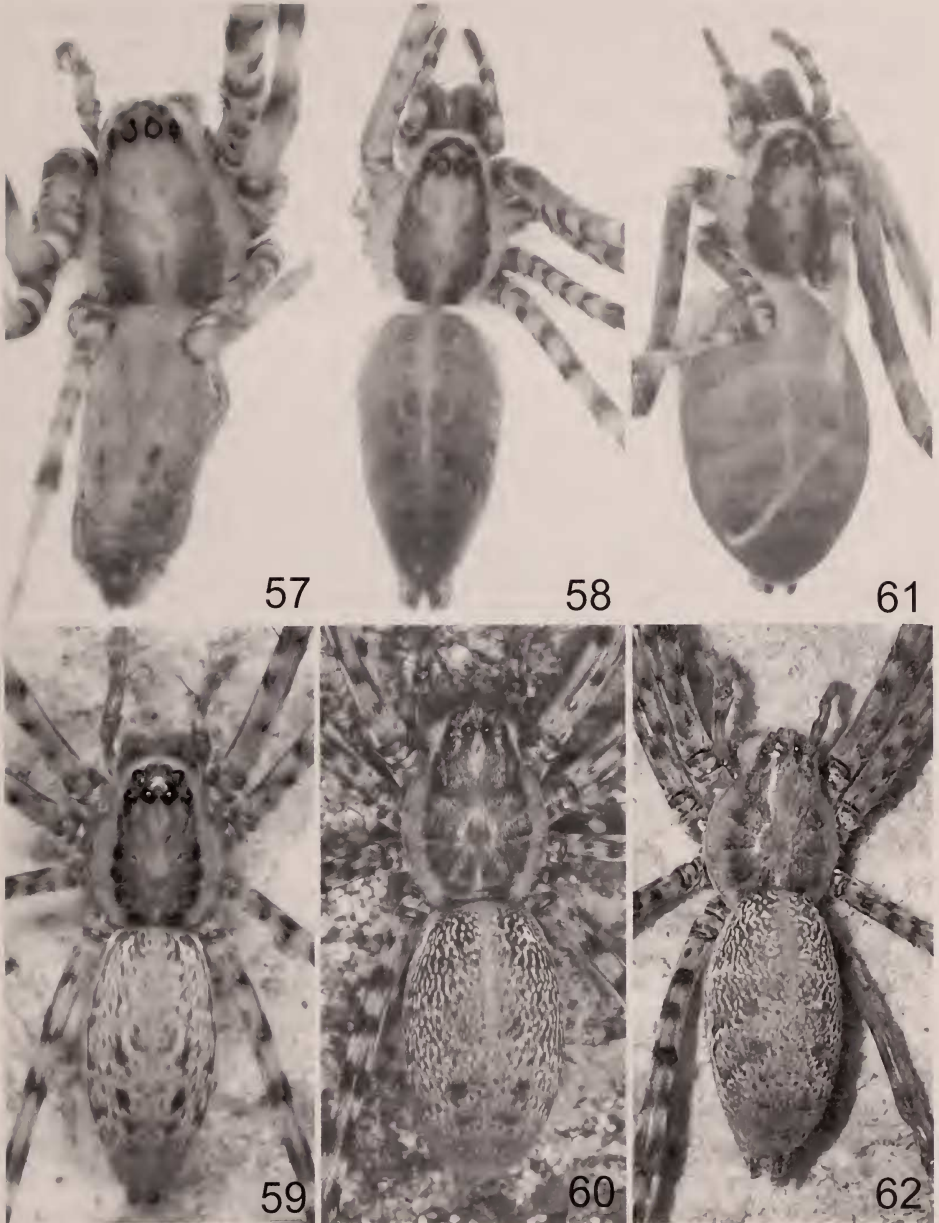
holotype) teeth. Like in most *Psechrus* species (also in *P. steineri* sp. n. and *P. antraeus* sp. n.), primary tooth distinctly stronger developed than other teeth (Fig. 37).

Spination. Palp: 131, 110, 1101, 1014 (131, 110, 1101, 1013, n=10; 131, 110, 1101, 1012, n=1; 131, 110, 1101, 1014, n=3) legs: femora I-III 556, IV 555 (I-II 556, III-IV 555, n=7; I-III 556, IV 555, n=5); patellae I-IV 000 (I-IV 000); tibiae I-II 3038, III 3034, IV 3036 (I-II 3038, III-IV 3036, n=5; I-II 3038, III-IV 3034, n=3; I-II 3038, III 3034, IV 3036, n=7); metatarsi I-III 3035, IV 3034 (I-III 3035, IV 3034, n=7; I-IV 3035, n=7).

Measurements of palp and legs. Palp 9.0 (6.1-9.3) [3.1 (2.0-3.1), 1.4 (0.9-1.5), 1.6 (1.1-1.6), 2.9 (2.1-3.1)] , I 40.0 (29.9-44.4) [11.0 (8.0-12.0), 3.1 (2.1-3.2), 11.2 (8.2-12.4), 10.0 (7.8-12.2), 4.7 (3.8-4.7)], II 32.5 (24.0-36.1) [9.5 (6.8-10.2), 2.7 (1.8-2.9), 8.5 (6.3-9.6), 7.9 (5.9-9.2), 3.9 (3.2-4.2)], III 23.7 (16.9-25.4) [7.0 (5.0-7.5), 2.2 (1.4-2.3), 5.8 (4.1-6.2), 5.8 (4.1-6.3), 2.9 (2.3-3.2)], IV 32.8 (24.2-36.9) [9.5 (6.9-10.6), 2.4 (1.7-2.6), 8.6 (6.0-9.6), 8.1 (6.1-9.6), 4.2 (3.5-4.6)]. Leg formula: 1423 (1423, n=15).

Copulatory organ. In addition to characters of epigyne and vulva mentioned in diagnosis, lateral sections of median septum of epigyne with wrinkles (Figs 32, 44, 46, 48, 50, 52). Distance between copulatory openings approximately half as long as width of median septum. Epigynal field broader than long. At least 3 (one specimen with 6, Fig. 50) slit sense organs present, these varying in shape and position, but always situated outside epigynal field.

Colouration (Figs 61-62) as described for male.



FIGS 57-62

Psechrus spp., habitus, dorsal view. (57) *Psechrus steineri* sp. n., ♀ holotype. (58-60) *Psechrus antraeus* sp. n.; ♀ paratype SB 74 (58), juvenile alive (59) and ♀ alive (60) in Tham Pou Kham, Vientiane Prov., Laos. (61-62) *Psechrus ancoralis* sp. n.; ♀ SB 75 (61), ♀ alive (62) in Tham Nam Lot, Luang Prabang Prov., Laos. Fig. 62: Photo by H. Steiner.

VARIATION OF COPULATORY ORGANS: The palpal characters of the ♂ paratype SB 26 differ only slightly from those of SB 24. In SB 24 the basal part of the tegulum and the distal part of the tibia are slightly broader (Figs 26-28 cf. Figs 38-40). 15 ♀ examined show a relatively large variation. The median septum is relatively short in some individuals (Figs 46, 48). The distance between the copulatory openings is in some specimens shorter (Figs 50, 52) than in others. The curved wrinkles posteriorly and medially of the muscle sigilla are unequally developed (Fig. 32 cf. Fig. 50). The distance between the spermathecal bases varies (Fig. 49 cf. Fig. 51). The copulatory ducts are extending posteriorly to different extents (Fig. 45 cf. Fig. 47). Besides, length and shape of spermathecal heads may differ (Fig. 45 cf. Fig. 49).

Psechrus luangprabang Jäger, 2007

Fig. 63

NEW MATERIAL EXAMINED (6 ♂, 13 ♀): Laos, Luang Nam Tha Prov.: 2 ♂ (SB 21-22), Nam Ha Protected Area (2), 693 m, 21°06'43.0" N, 101°20'36.1" E, under bridge, by hand, P. Jäger leg. 6.III.2008, SB 21 in SMF, SB 22 in MHNG. – 1 ♀ (SB 6), Nam Ha Protected Area (3), 746 m, 21°08'17.6" N, 101°21'07.3" E, under bridge, by hand, P. Jäger leg. 6.III.2008, in SMF. – 3 ♂ (SB 48, 53-54), 3 ♀ (SB 49, 51-52), Nam Ha Protected Area (6), 589 m, 21°03'32.1" N, 101°24'03.0" E, under bridge, by hand, P. Jäger leg. 7.III.2008, in SMF. – Luang Prabang Prov.: 2 ♀ (SB 41-42), SE Luang Prabang, Nam Khan, Xieng Ngeun Distr., Ban Keng Koung, 372 m, 19°40'963" N, 102°18'442" E, vegetation along stream, by hand, at night, P. Jäger leg. 23.II.2008, in SMF. – 1 ♀ (SB 61), SE Luang Prabang, Nam Khan, Ban Pak Bak, Huoay Kho, 328 m, 19°44'09.1" N, 102°16'37.5" E, vegetation along stream, by hand, at night, P. Jäger leg. 23.III.2007, in SMF. – 1 ♂ (SB 67), 2 ♀ (SB 68-69), SE Luang Prabang, Nam Khan, Ban Nong Di, 281 m, 19°41'03.5" N, 102°21'31.2" E, vegetation along stream, by hand, at night, P. Jäger leg. 21.III.2007, in SMF. – Vientiane Prov.: 1 ♀ (SB 20), N of Vang Vieng, Ban Phoxay, 260 m, 19°00'59.4" N, 102°26'48.0" E, water duct under street, by hand, P. Jäger leg. 14.III.2008, in SMF. – 3 ♀ (SB 76, 91-92), N of Vang Vieng, Ban Phoxay, 250 m, 19°00'59.4" N, 102°26'48.0" E, valley east of road, vegetation along stream, by hand, P. Jäger, M. Sandner & F. Steinmetz leg. 14.III.2007, SB 92 in MHNG, others in SMF.

DISCUSSION

Psechrus species are difficult to catch because the spiders are extremely fast in escaping when somebody approaches the web (Murphy & Murphy, 2000). Because of that, it requires some patience or skill to catch them, especially when the retreat is located in a rock crevice. The present paper provides evidence that the Laotian *Psechrus* fauna is diverse. Extrapolating from species-richness conditions in Laos it is likely that the diversity in other SE-Asian countries is also higher than currently known. Our study (among others, see introduction) gives an impression of what is to be expected in the future concerning *Psechrus* diversity in SE-Asia, if further intensive collecting will be carried out.

Relationships of the species described herein are not easy to establish. The males of all species described herein lack modifications of the palpal femora, and their bulbs are rather ordinarily build. *Psechrus steineri* sp. n. is most likely closely related to *P. khammouan* Jäger, 2007, because the main somatical characters are similar (e.g., absence of modifications on palpal femur of males, absence of short and pointed macrosetae on coxae I of males, colour pattern, such as shape of dorsal median bands of prosoma, as shown in Jäger [2007: fig. 66] and Fig. 57). Also characters of the copulatory organs are similar, like general shape of tegulum in males and position of spermathecae and copulatory ducts, and similar median septum in females.

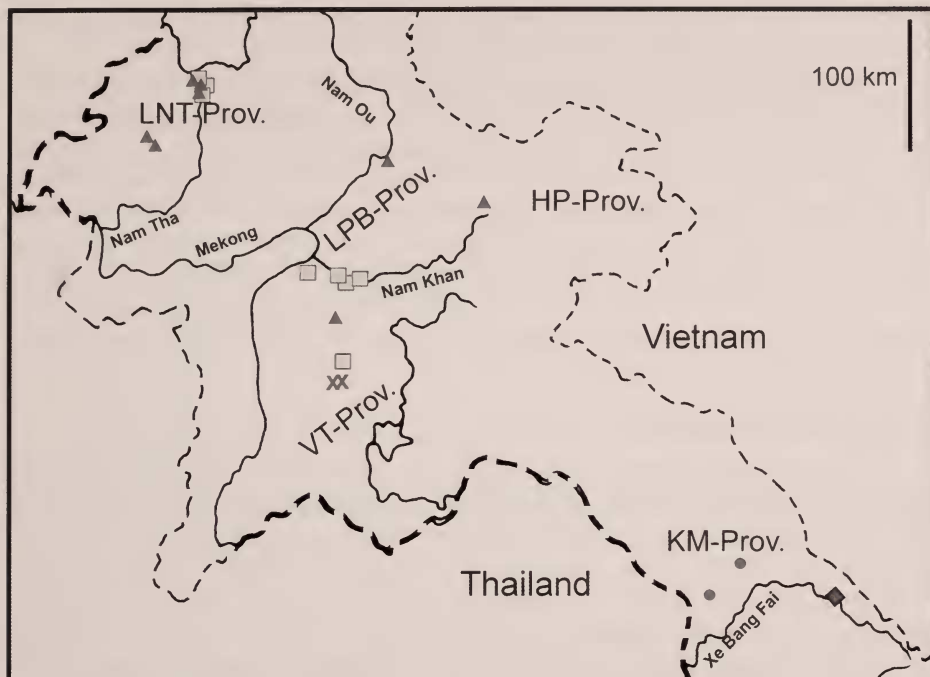


FIG. 63

Localities of *Psechrus* species in the northern part of Laos. Triangle - *P. ancoralis* sp. n.; square - *P. luangprabang* Jäger, 2007; x - *P. antraeus* sp. n.; circle - *P. khammouan* Jäger, 2007; diamond - *P. steineri* sp. n. Provinces are abbreviated as follows: HP - Huaphan; LNT - Luang Nam Tha; LPB - Luang Prabang; KM - Khammouan; VT - Vientiane.

In the description of *P. ancoralis* sp. n. we mentioned that its male palp is similar to that of *P. rani*. In comparison with the drawings in Wang & Yin (2001: figs 13-14), there are subtle differences. Enigmatic is their fig. 14, giving a retrolateral view of the male palp, which does not correspond to their fig. 13 (ventral view), because the conductor is uniformly shaped in the former figure (division in two parts, voluminous base and slim part distally not apparent). Their fig. 14 strongly resembles our illustrations of the retrolateral aspect of the male palp of *P. ancoralis* sp. n. (Figs 28, 40). Given, that the locality of the female paratype of *P. rani*, which shows less similarities to the females of *P. ancoralis* sp. n., and the locality of the male holotype of *P. rani* are not exactly the same, it is possible that these two specimens are not conspecific. We had no possibility to examine the male holotype of *P. rani*, so we rely on the drawing of the ventral view of the male palp of *P. rani* given in Wang & Yin (2001: fig. 13). We assume that fig. 14 in Wang & Yin (2001) does not show all details of the conductor, because it was not well visible (not fully silhouetted) against the beige-white sand in the background, which is often used by taxonomists when making drawings.

Concerning the females, *Psechrus antraeus* sp. n. may be closely related to *P. singaporensis*, because their copulatory organs are similar (Figs 18-19, cf. Figs 24-25). However, the male palp of *P. singaporensis* (see fig. 40 in Levi, 1982) is not very

similar to that of *P. antraeus* sp. n. Moreover, a modification of the male palp, as in *P. singaporensis*, is not present in *P. antraeus* sp. n.

At present the taxonomic status of many *Psechrus* species is doubtful. One of the reasons is that some species described at the end of the 19th century or in the first half of the 20th century are based on juvenile (penultimate instar) types, e.g., *Psechrus ghecuanus* (Thorell, 1897) or *P. mimus* (Chamberlin, 1924). Those authors (Thorell, 1897; Chamberlin, 1924) did not recognize the type specimens as immatures. In other cases the types are in poor condition or important body parts are missing. Moreover, some (nominal) species were synonymised by Lehtinen (1967) or Levi (1982) without good reasons. Hence, a comprehensive revision of the genus *Psechrus* by means of morphological as well as molecular characterisation is necessary to clarify taxonomical status and relationships of each species.

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